

# Evaluation of Compression Garments as Countermeasures to Orthostatic Intolerance

Completed Technology Project (2007 - 2008)



## Project Introduction

Previous work in our laboratory demonstrated that the NASA Anti-Gravity Suit and the Russian Kentavr compression garment were effective countermeasures to orthostatic intolerance in subjects whose plasma volume was reduced pharmacologically to a similar degree as experienced by astronauts. While these compression garments were effective in these conditions, two observations led to the evaluation of other compression garments/conditions. First, although the AGS and Kentavr appeared to be equally effective in the initial study, the level of compression provided by the two garments were very different. The Kentavr provided compression of ~30 mmHg but the AGS was inflated to a pressure of ~78 mmHg. Thus, one objective of this study was to determine whether the AGS could provide a similar level of protection as the Kentavr when the AGS was inflated to provide a similar level of compression (~26 mmHg). Second, astronauts have reported uncomfortable levels of abdominal compression while using the AGS, which may be particularly problematic after completing the pre-landing fluid loading protocol. Therefore, the second objective of this study was to determine the efficacy of a thigh-high compression garment, which might be more effective than either the AGS or the Kentavr because it provided a gradient compression to promote venous return. Both the AGS and Kentavr apply approximately the same level of compression across the entire length of the garment, but a commercially-available garment provides the highest pressure at the ankle, and the pressure decreases up the leg to the top of the thigh. Both garments were evaluated in normal healthy subjects who were hypovolemic due to the infusion of furosemide (Lasix), as has been previously used in our laboratory. The specific aims of this study were: 1. Evaluate the effectiveness of thigh-high compression garments to prevent orthostatic intolerance in hypovolemic subjects. 2. Evaluate the effectiveness of the Anti-Gravity Suit (AGS) at 1 "click" (0.5 psi) to prevent orthostatic intolerance in hypovolemic subjects. 3. Compare the effectiveness of the two garments which provide similar average levels of compression across their respective lengths but provide different levels of coverage (thigh-high vs. abdomen-high).

## Anticipated Benefits

Differences in the level of protection despite similar average levels of compression provided by the two garments suggest that differences in the amount of coverage of the two garments (thigh-high compression garments vs. abdomen-high AGS) tested in this study is a key factor in the design of orthostatic intolerance countermeasure garments.



Evaluation of Compression Garments as Countermeasures to Orthostatic Intolerance

## Table of Contents

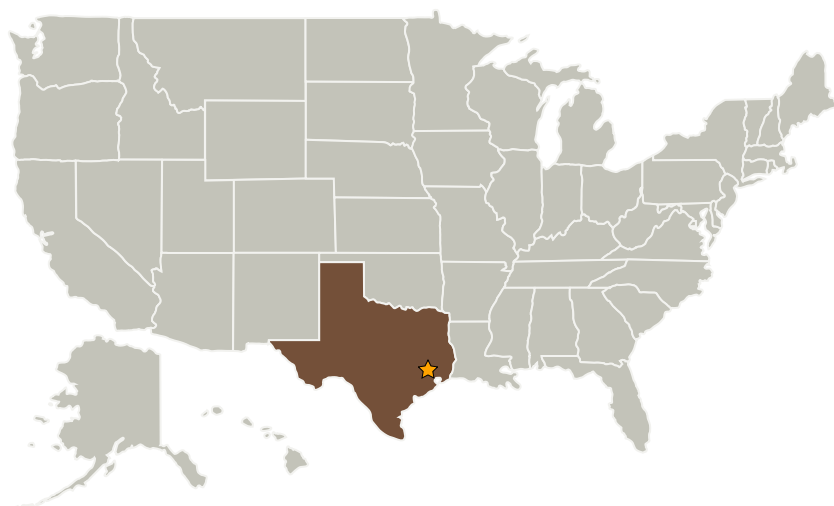
Project Introduction	1
Anticipated Benefits	1
Primary U.S. Work Locations and Key Partners	2
Project Transitions	2
Organizational Responsibility	2
Project Management	2
Project Website:	3
Technology Maturity (TRL)	3
Technology Areas	3
Target Destinations	3

## Evaluation of Compression Garments as Countermeasures to Orthostatic Intolerance

Completed Technology Project (2007 - 2008)



## Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★ Johnson Space Center(JSC)	Lead Organization	NASA Center	Houston, Texas
Wyle Laboratories, Inc.	Supporting Organization	Industry	

## Primary U.S. Work Locations

Texas

## Project Transitions

 **March 2007:** Project Start **August 2008:** Closed out

**Closeout Summary:** New project for FY2007. [Ed. note 9/12/2013: added to Task Book when received information from HRP]

## Organizational Responsibility

**Responsible Mission Directorate:**

Space Operations Mission Directorate (SOMD)

**Lead Center / Facility:**

Johnson Space Center (JSC)

**Responsible Program:**

Human Spaceflight Capabilities

## Project Management

**Program Director:**

David K Baumann

**Project Manager:**

Jennifer D Villarreal

**Principal Investigator:**

Steven H Platts

**Co-Investigators:**

Michael B Stenger

David L Martin

Letetia M Richardson

# Evaluation of Compression Garments as Countermeasures to Orthostatic Intolerance

Completed Technology Project (2007 - 2008)

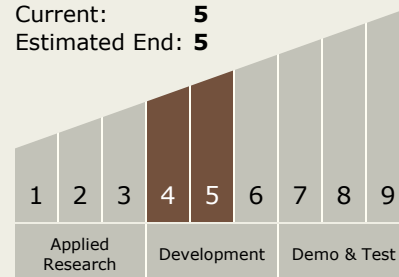


## Project Website:

<https://taskbook.nasaprs.com>

## Technology Maturity (TRL)

Start: **4**  
Current: **5**  
Estimated End: **5**



## Technology Areas

### Primary:

- TX06 Human Health, Life Support, and Habitation Systems
  - └ TX06.3 Human Health and Performance
    - └ TX06.3.2 Prevention and Countermeasures

## Target Destinations

The Moon, Mars